



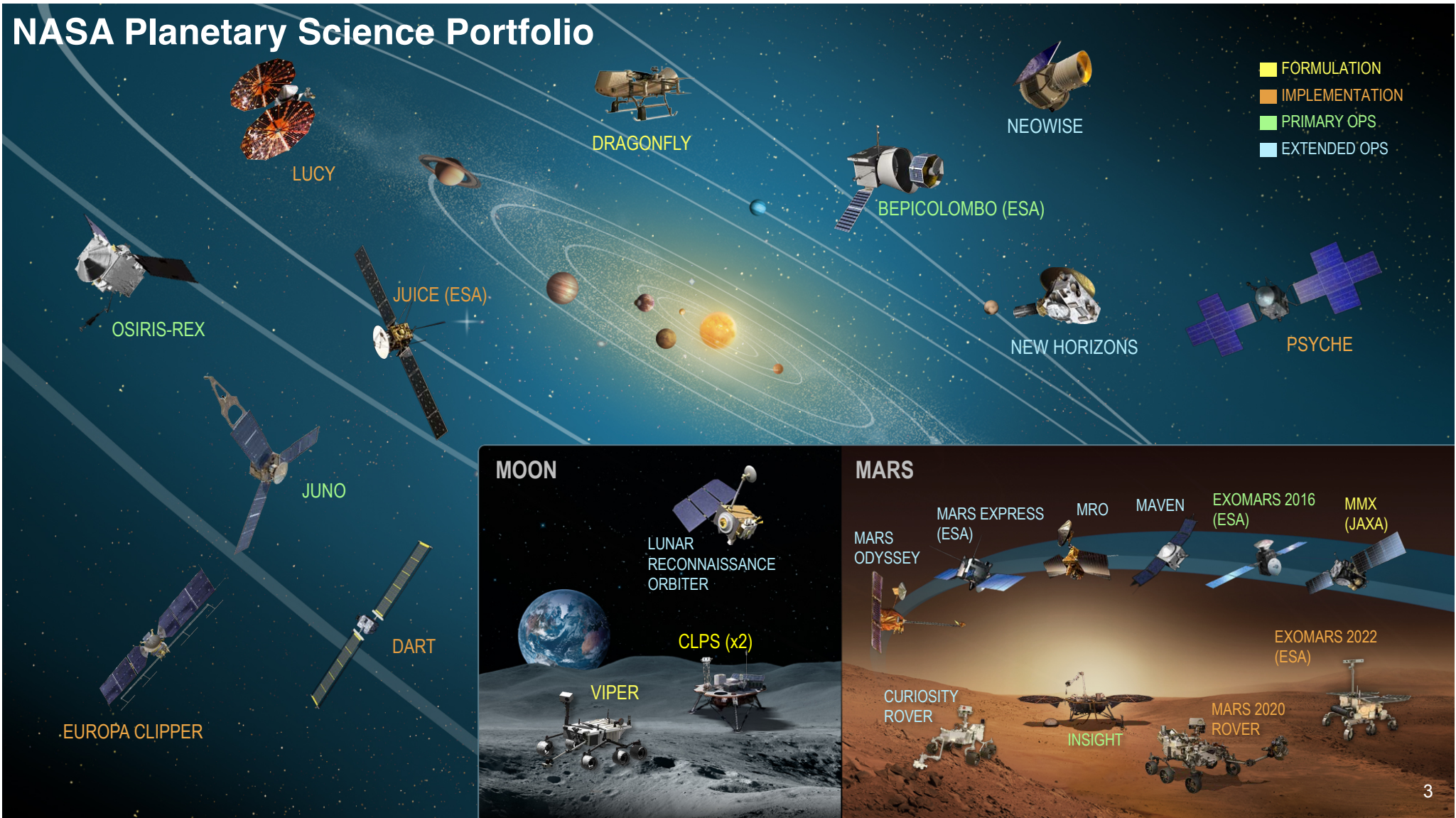
Planetary Science Directorate

Future Directions and Challenges

October 28, 2020

NASA Planetary Science Portfolio

- FORMULATION
- IMPLEMENTATION
- PRIMARY OPS
- EXTENDED OPS



MOON

LUNAR RECONNAISSANCE ORBITER

CLPS (x2)

VIPER

MARS

MARS ODYSSEY

MARS EXPRESS (ESA)

MRO

MAVEN

EXOMARS 2016 (ESA)

MMX (JAXA)

EXOMARS 2022 (ESA)

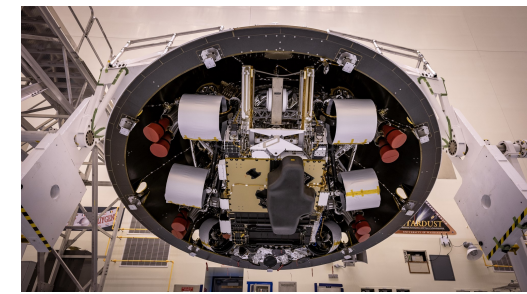
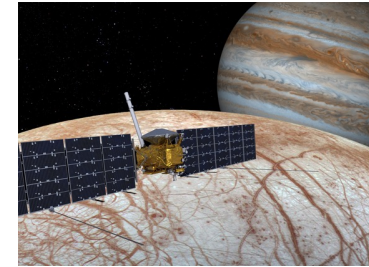
CURIOSITY ROVER

INSIGHT

MARS 2020 ROVER

Executing Our Present Portfolio

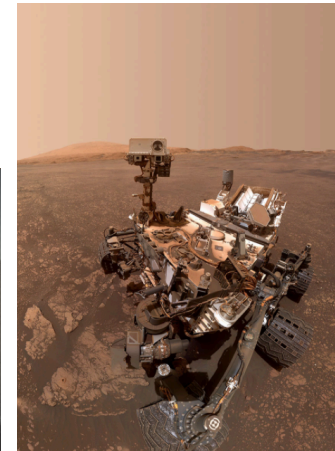
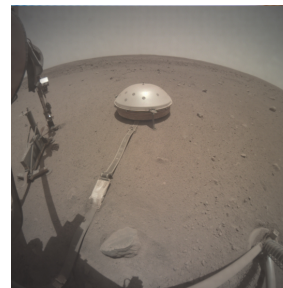
- The JPL Planetary Science Directorate was created on March 30, 2020 through a merger of the former Mars Exploration and Solar System Exploration Directorates
- JPL's Planetary Science Directorate portfolio includes
 - 4 Type-I flight projects (M2020, RIME, Psyche, Clipper)
 - 2 Type-I flight projects in formulation (Veritas, Trident)
 - 1 new program in formulation (Mars Sample Return)
 - 5 Type-I JPL-led missions in operations (Insight, Juno, MSL, MRO, Odyssey)
 - 2 Type-II flight projects in development (Lunar Flashlight, Lunar Trailblazer)
 - A broad range of research and technology efforts
 - Planning, communications and strategy activities



Psyche Xenon Module



RIME FM Transmitter



Planetary Science Directorate Strategic Objectives

- Operate with a science-first mentality in the conduct of all activities
- Successfully deliver and operate each planetary science project within the required technical, cost and schedule constraints
- Increase the pace of new technology infusion, pioneer the use of new business practices and create strategic partnerships for the Lab in the planetary science & astrobiology domains
- Expand the engagement of the broader planetary science community in PSD activities
- Improve alignment and communications with NASA HQ and our partner organizations
- Improve integration & communication of our priorities and challenges across the Lab
- Formulate, develop and operate planetary science missions which only JPL can.

4x Strategy:

Position our community for the grand planetary science missions of the future

Planetary Science Directorate Tactical Objectives

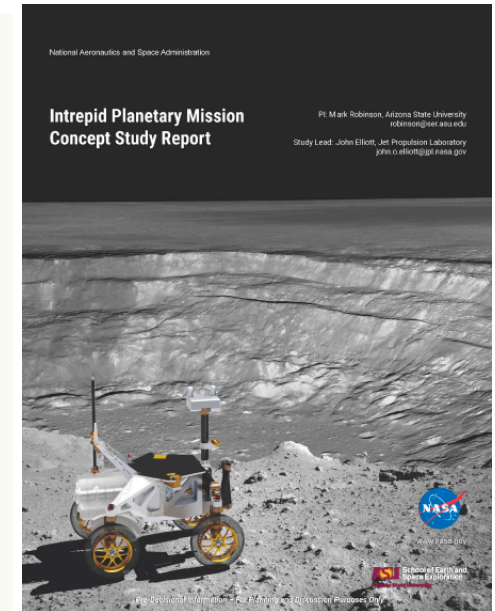
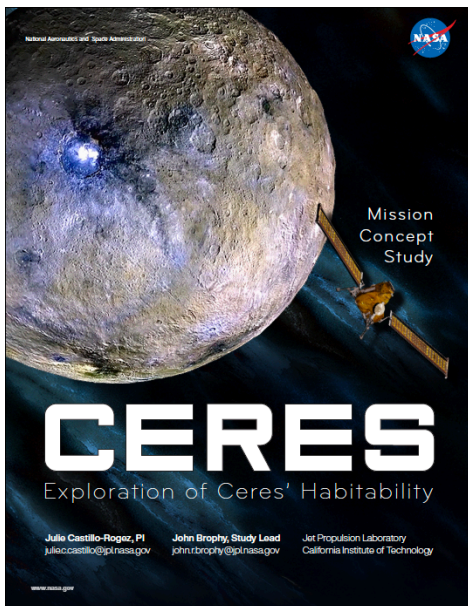
- Provide strong oversight of M2020, Psyche, RIME, Clipper, MSR and other planetary science missions
- Ensure continuity of NASA HQ MEP functions assigned to JPL
- Establish MSR external to MEP (per recent NASA HQ actions) and formulate an implementable program with low cost risk
- Balance visibility, leadership and coordination across the Technology, Formulation, Development and Operations aspects of Directorate
- Win Discovery
- Take a fresh-look at planetary science program office functions
 - Improve alignment and communications with NASA HQ
 - Strengthen alignment and visibility with science community
 - Ensure strong advocacy for planetary science going forward

Key Priorities Going Forward

- Successfully Execute Current Portfolio
- Play to Win – or Choose Not to Play – in Competitive Mission Environment
- Work with Community through Decadal Process
- Rebuild at least one strategic industry partner relationship
- Strengthen partnerships with Academia and key NASA Centers
- Establish and implement Mars Sample Return Program
- Grow astrobiology research and create Ocean World exploration missions
- Prioritize technology investments in Landing, Mobility, Sampling
- Lead STEM community in diversity, equity and inclusion

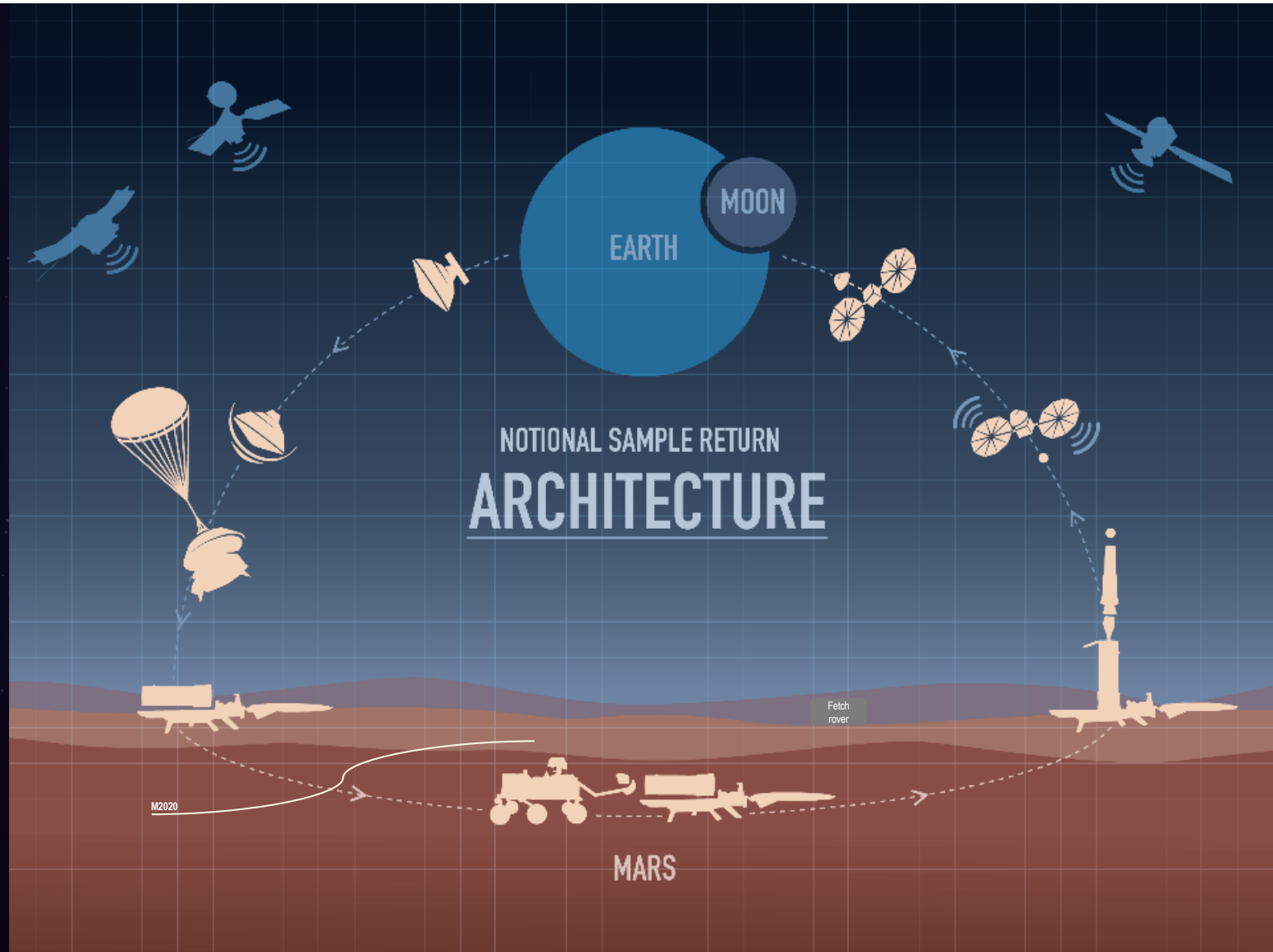
The Planetary Science and Astrobiology Decadal Survey 2023-2032

- Steering Committee recently announced
- 11 Pre-Decadal Mission Concept Studies (4 were JPL-led):



- An overwhelming community response with >500 White Papers:

<https://www.nationalacademies.org/our-work/planetary-science-and-astrobiology-decadal-survey-2023-2032>



NOTIONAL SAMPLE RETURN ARCHITECTURE

EARTH

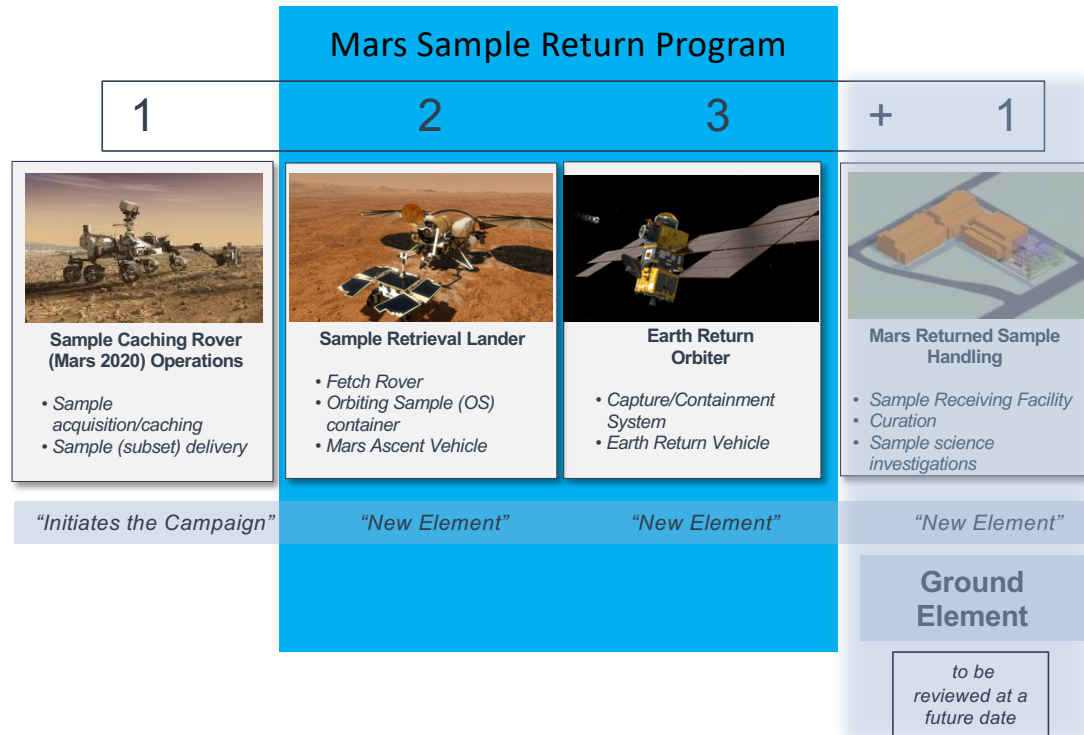
MOON

MARS

M2020

Fetch
rover

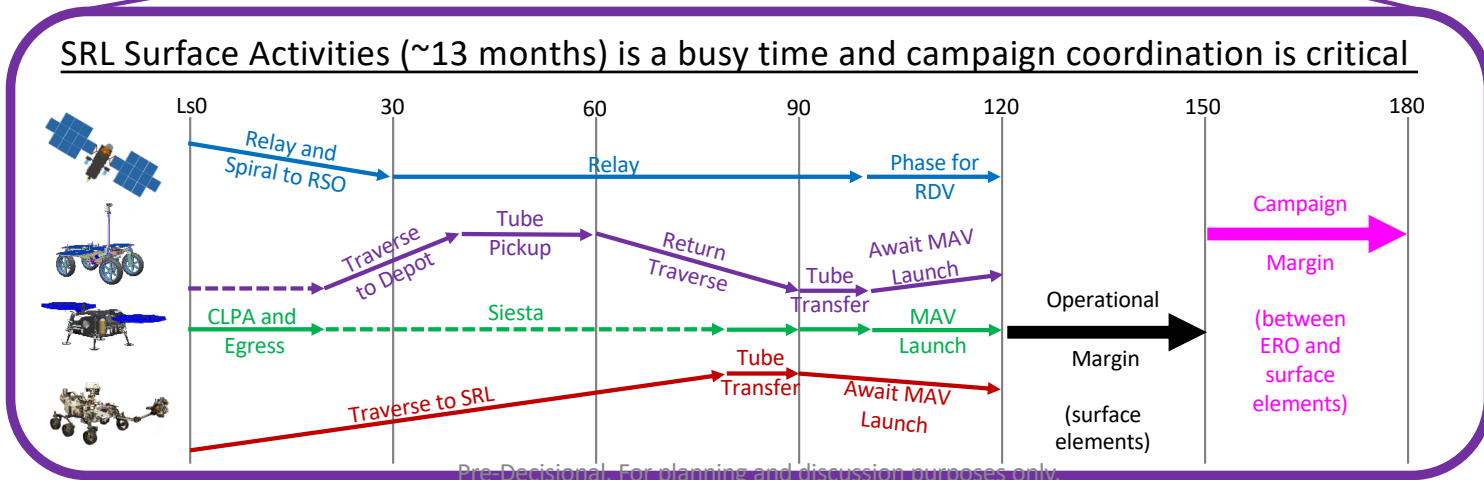
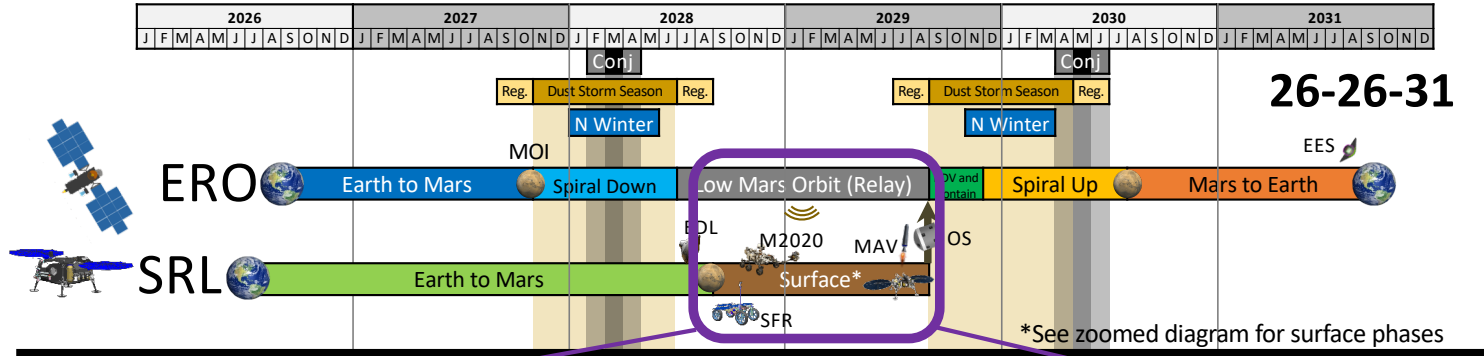
MSR Campaign



- The MSR Campaign spans three launches and one ground element

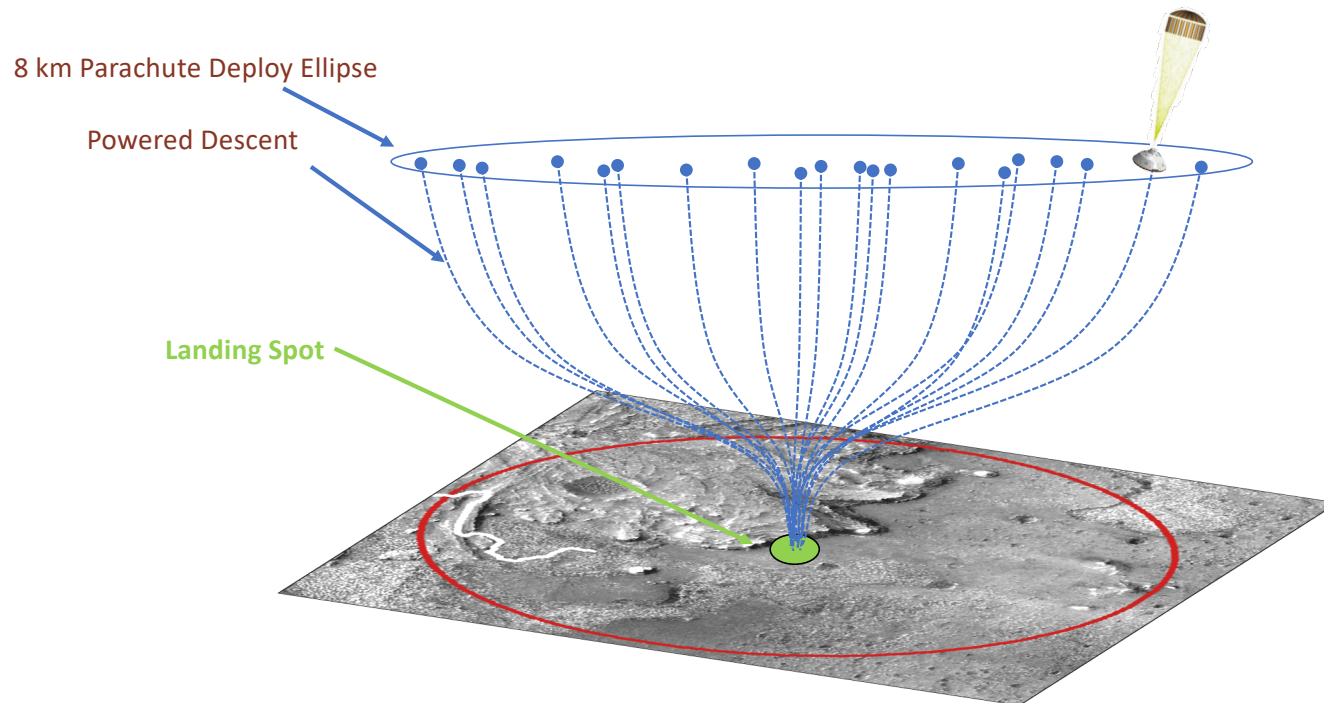
Pre-Decisional. For planning and discussion purposes only.

Campaign Timeline Overview



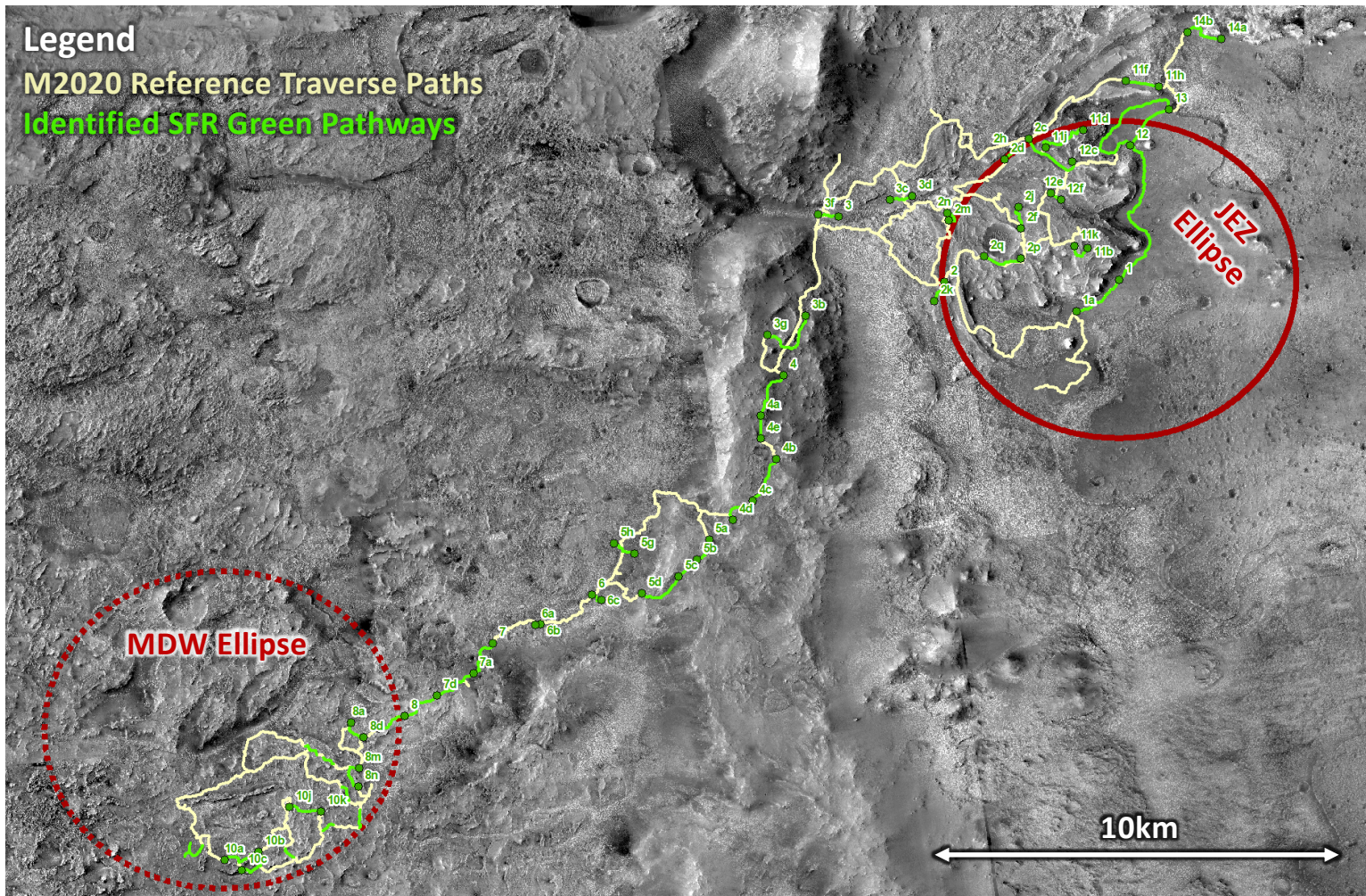
SRL EDL - Extended Divert

- SRL will carry enough propellant to fly out the backshell separation ellipse (8 x 8 km) and land at a specific spot ($\sim\pm 20\text{m}$ accuracy)
- Enables new capability of landing at a specific site scouted by Mars 2020



Pre-Decisional. For planning and discussion purposes only.

Overview of Green Pathways Across Jezero-Midway Region



Resiliency Decision and Use of Sample Safe States

- Through architecture design, created numerous sample-safe states and decisions events
 - Mars 2020 planning to acquire some duplicate samples
 - Sealed sample tubes are designed to survive on the Mars surface for a minimum of 10 years
 - Functionally redundant paths for delivering samples to SRL (M2020 and SFR)
 - OS orbit is designed to be stable for a minimum of 10 years
 - OS designed to be capable of returning as many as 30 samples
- Team is looking carefully for additional resiliency options and using resiliency to guide decision making

Challenge

- Implementation of MSR will be challenging and will take the best efforts of each partner organization
 - New approach to SMD flagship missions
 - Significant chain of events required for MSR success
 - New development challenges include the MAV, CCRS, EEV and SRL
 - Strong technical, cost and schedule management required

Risk	M2020 Experience	MSR Challenge
Implementation Approach	Traditional SMD Project	Program of two launch projects with interfaces to M2020 and SHF.
International Partnership	Focused on instruments	International partnership with one launch project led by each Agency partner and interwoven payloads
NASA Implementation Approach	JPL w/targeted support from other NASA Centers; Make with component subs	Multi-Center; Considering more significant engagement of U.S. industry
Complexity	<ul style="list-style-type: none"> • Large, diverse suite of competitively-selected science & tech payloads • Unique and sophisticated mission-critical sampling system 	<ul style="list-style-type: none"> • Two massive and volumetrically different SRL payloads, each under development • Unique and sophisticated mission-critical CCRS
Mission System	Traditional single launch, cruise, EDL, surface operations	Multi-mission launch, cruise, EDL, surface plus ascent, rendezvous and return phases
Operations	Demanding surface mission timeline	Demanding surface mission timeline
Cost/Schedule Phasing	Early funding to complete heritage H/W	Early funding to complete engineering developments; 6-yr development requires significant increase in annual expenditures (relative to M2020) over lifecycle

Opportunity

- With launch of Perseverance, the MSR Campaign is underway
- MSR is drawing upon the best talent from across NASA and ESA
- It's the most important planetary science undertaking in a generation
- This team has developed a feasible baseline and broad set of options to discuss with NASA HQ as part of the KDP-A decision process
- The time is now to leverage MEP investments and technology advancements

Leading in Diversity, Equity and Inclusion

- For decades, JPL culture has been built on mission success
- This is not enough.
- JPL exists to grow the community and has the opportunity to lead in many ways, including through diversity, equity & inclusion

Actions and vision for what we should strive to accomplish:

- Be Transparent
- Be Inclusive
- Be Equitable
- Communicate
- Collaborate
- Set Significant Goals
- Measure Progress



The image is a composite space-themed background. On the left side, the rings of Saturn are visible, showing various shades of brown and tan. On the right side, a bright star is positioned, creating a prominent lens flare with multiple rays of light extending outwards. The overall background is a deep, dark blue-black color.

Thank you